Helwan University
Faculty of Engineering – Mataria

A Course on

Energy Conservation

HVAC Systems

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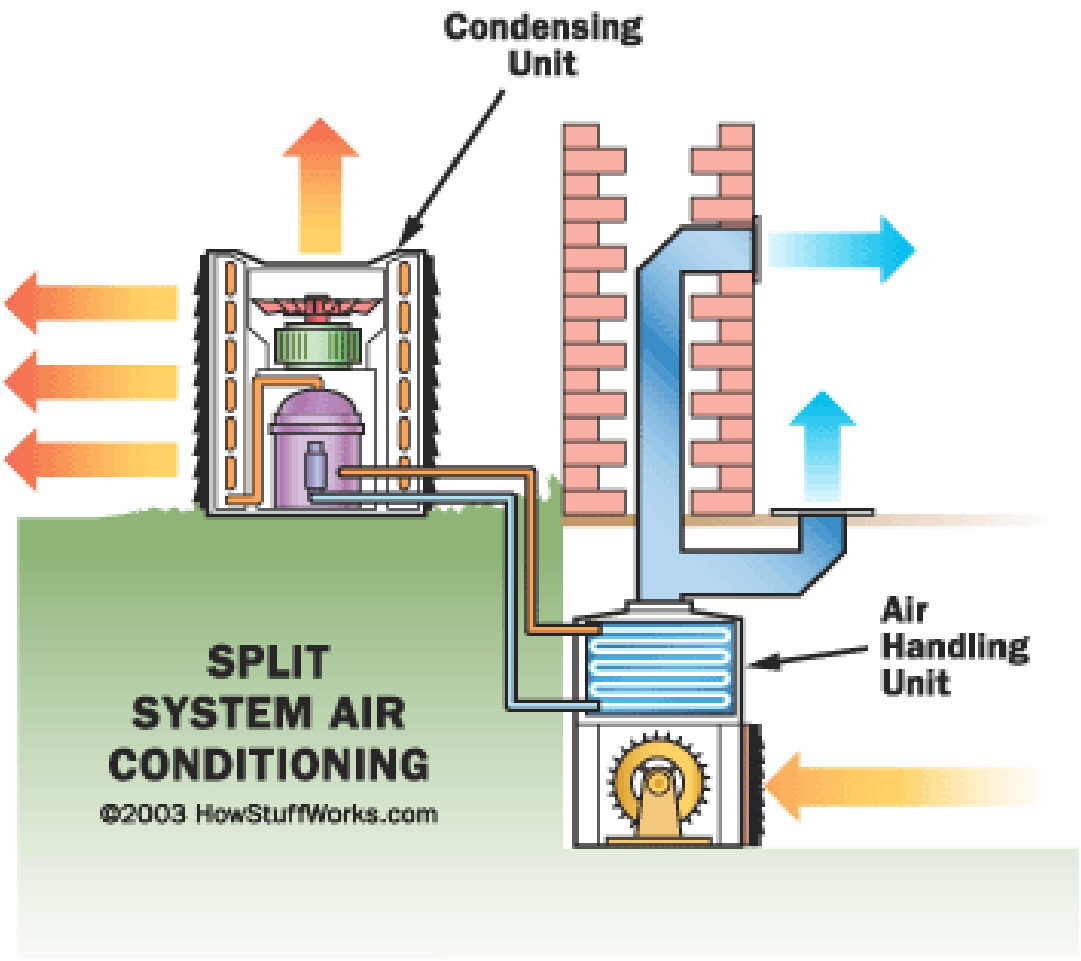
WHAT IS AIR CONDITIONING?

Is treating air for:

- **Temperature**
- **Cleanliness**
- **Humidity**
- **Directing it to a conditioned space.**

WHAT IS THE BASIC HVAC DESIGN?

Can vary in design and complexity



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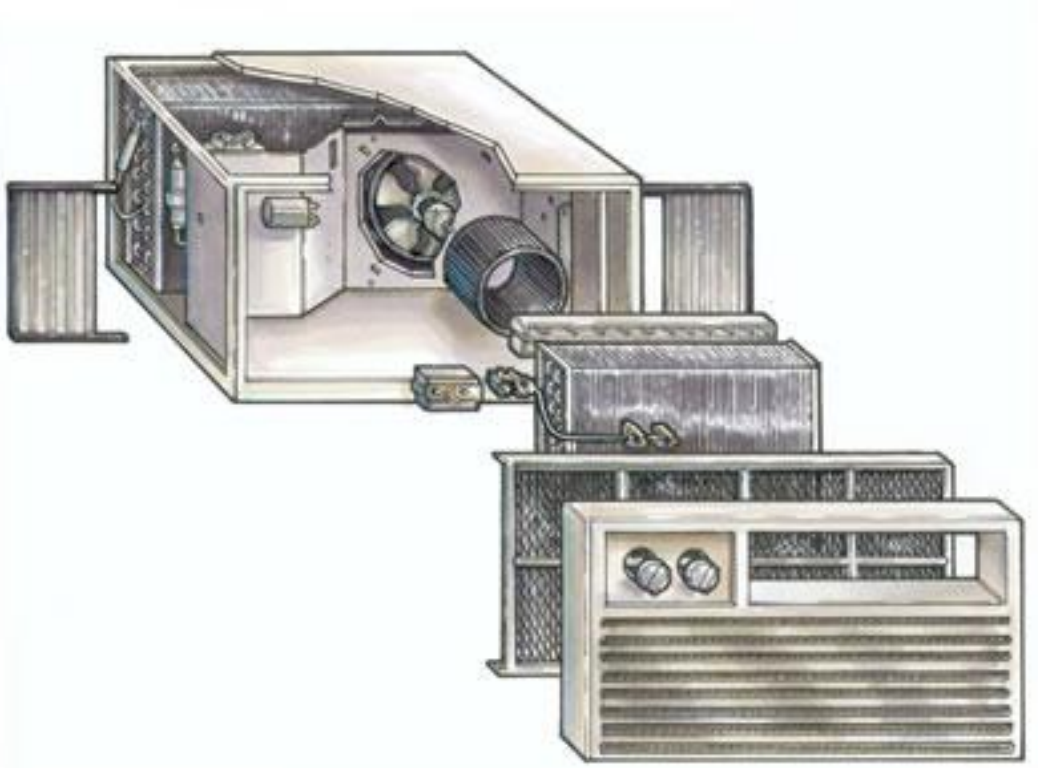

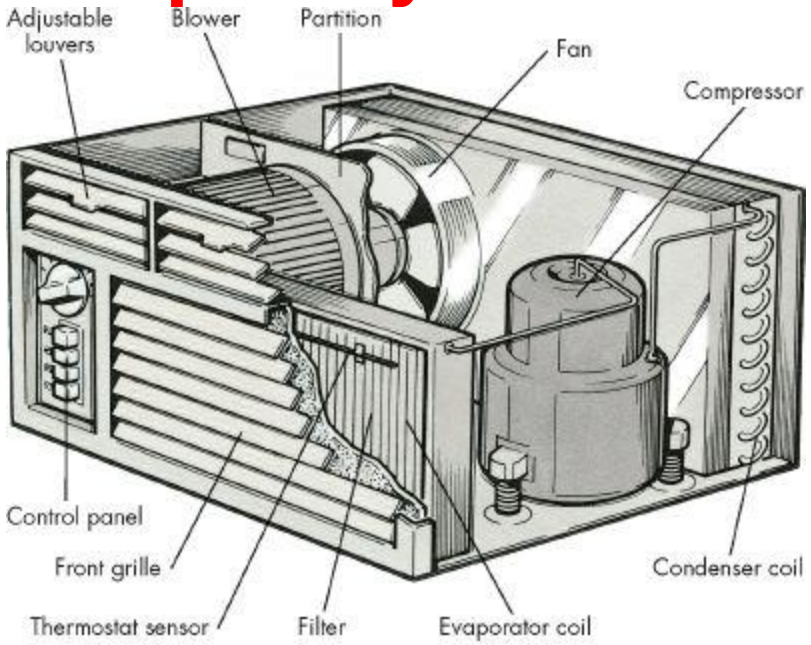

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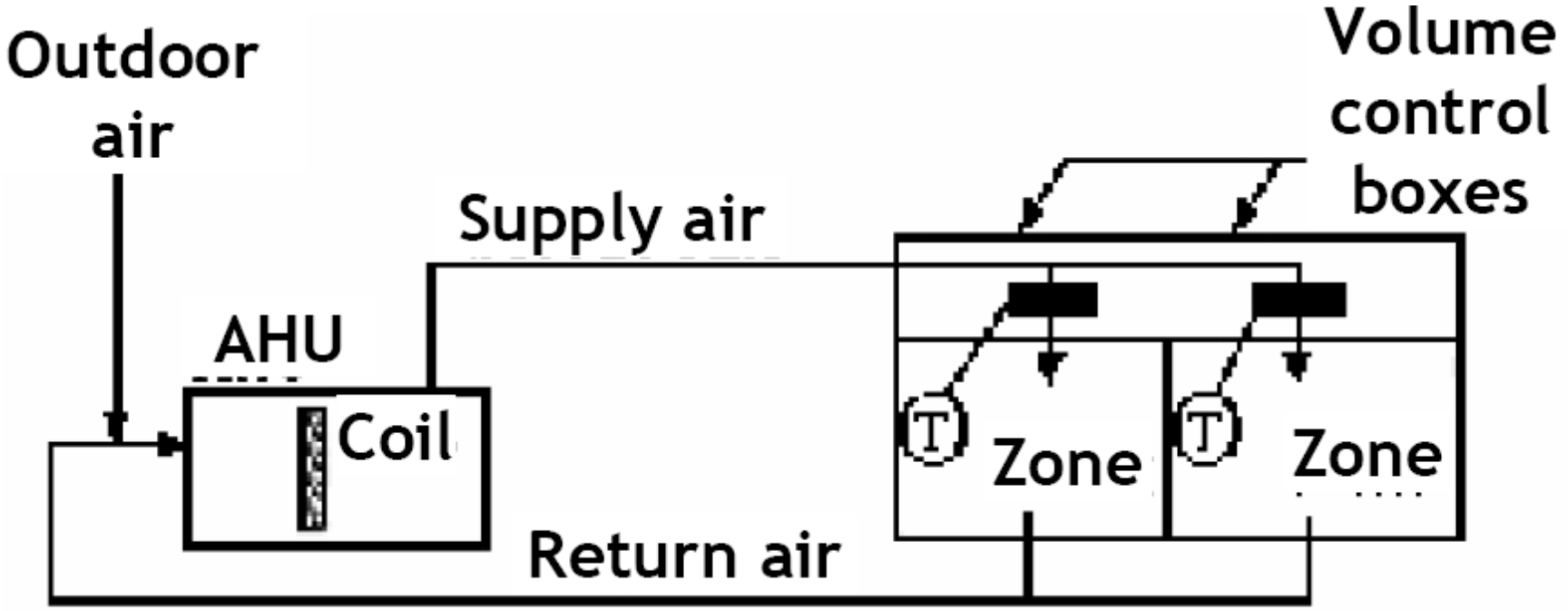

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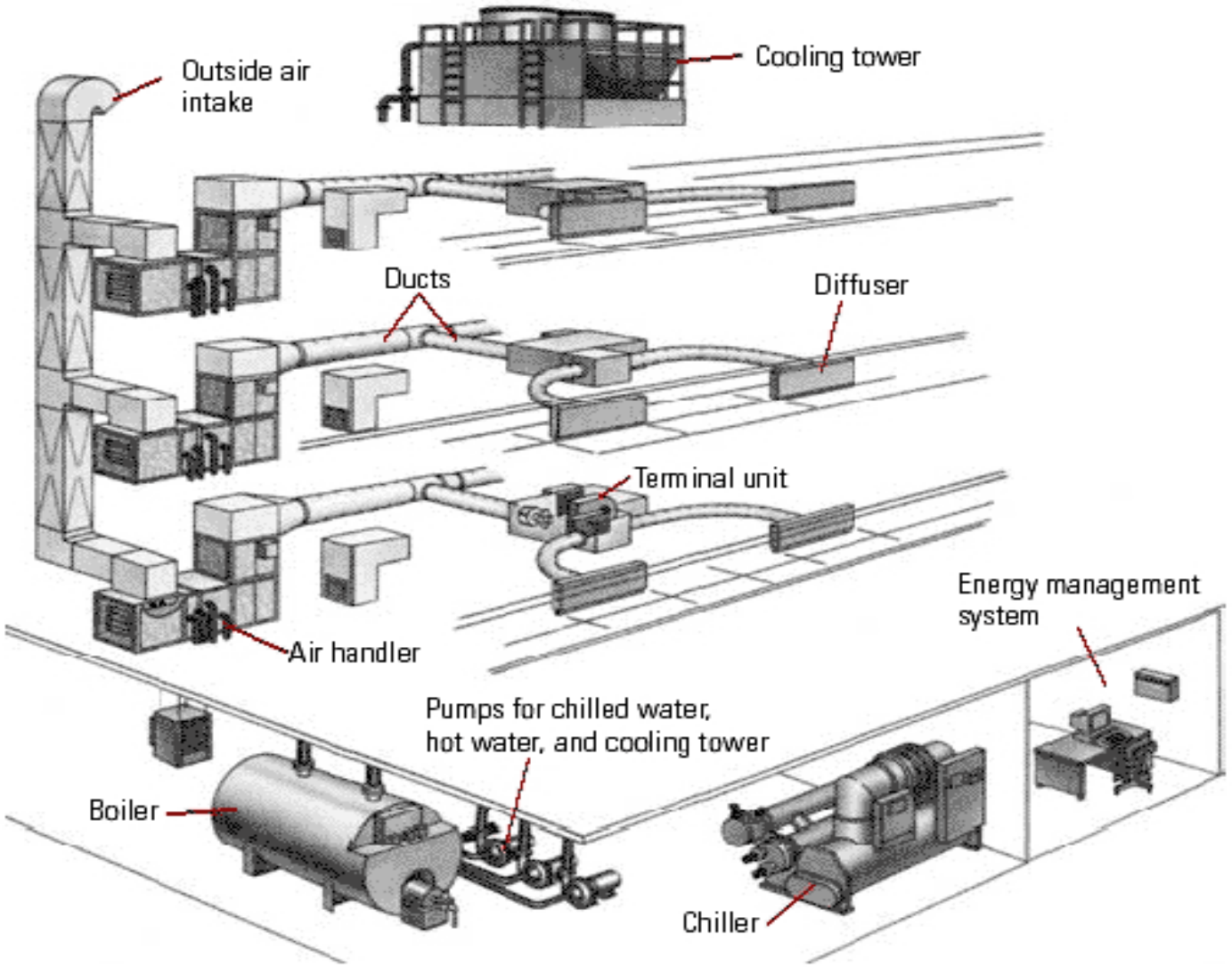
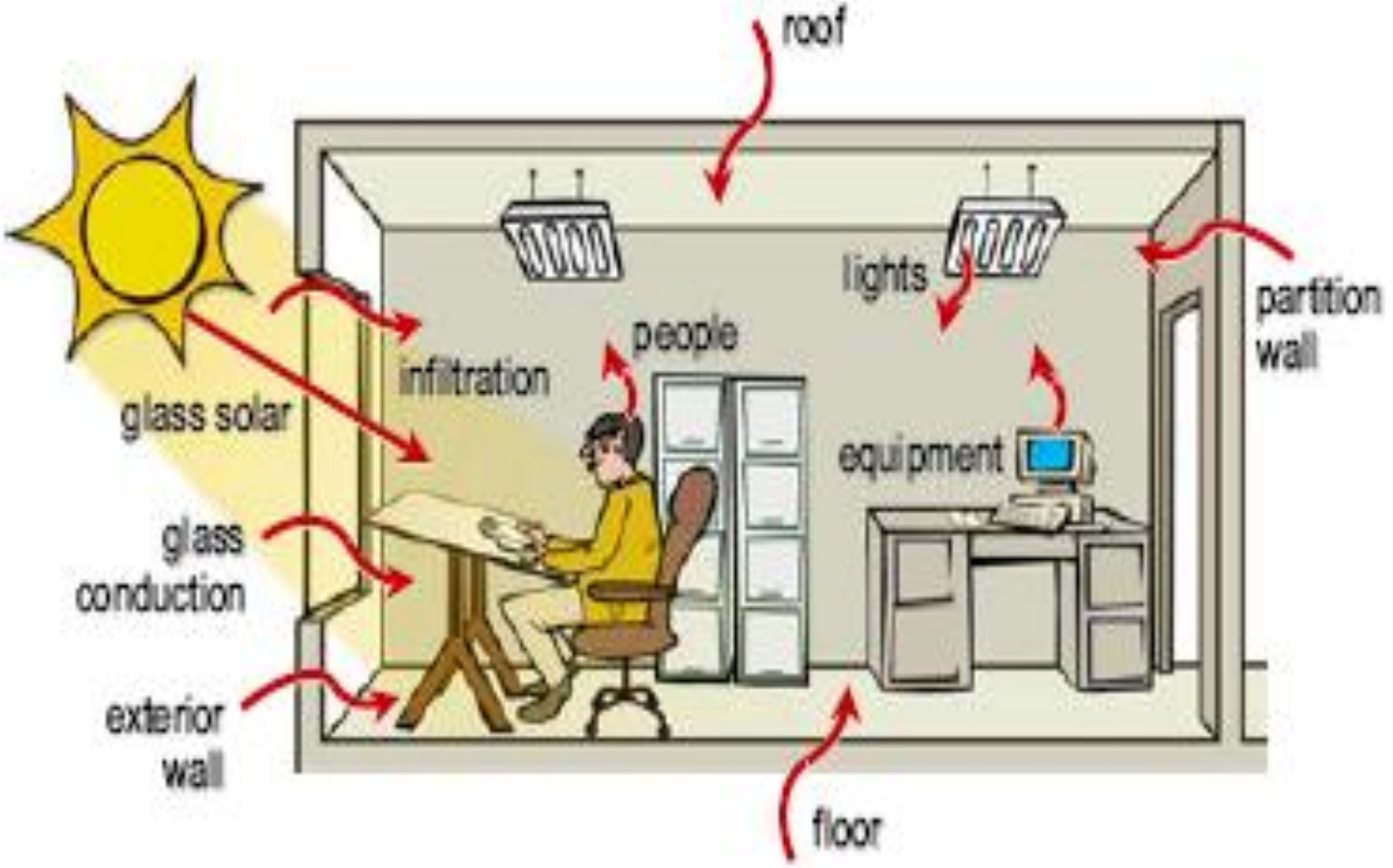
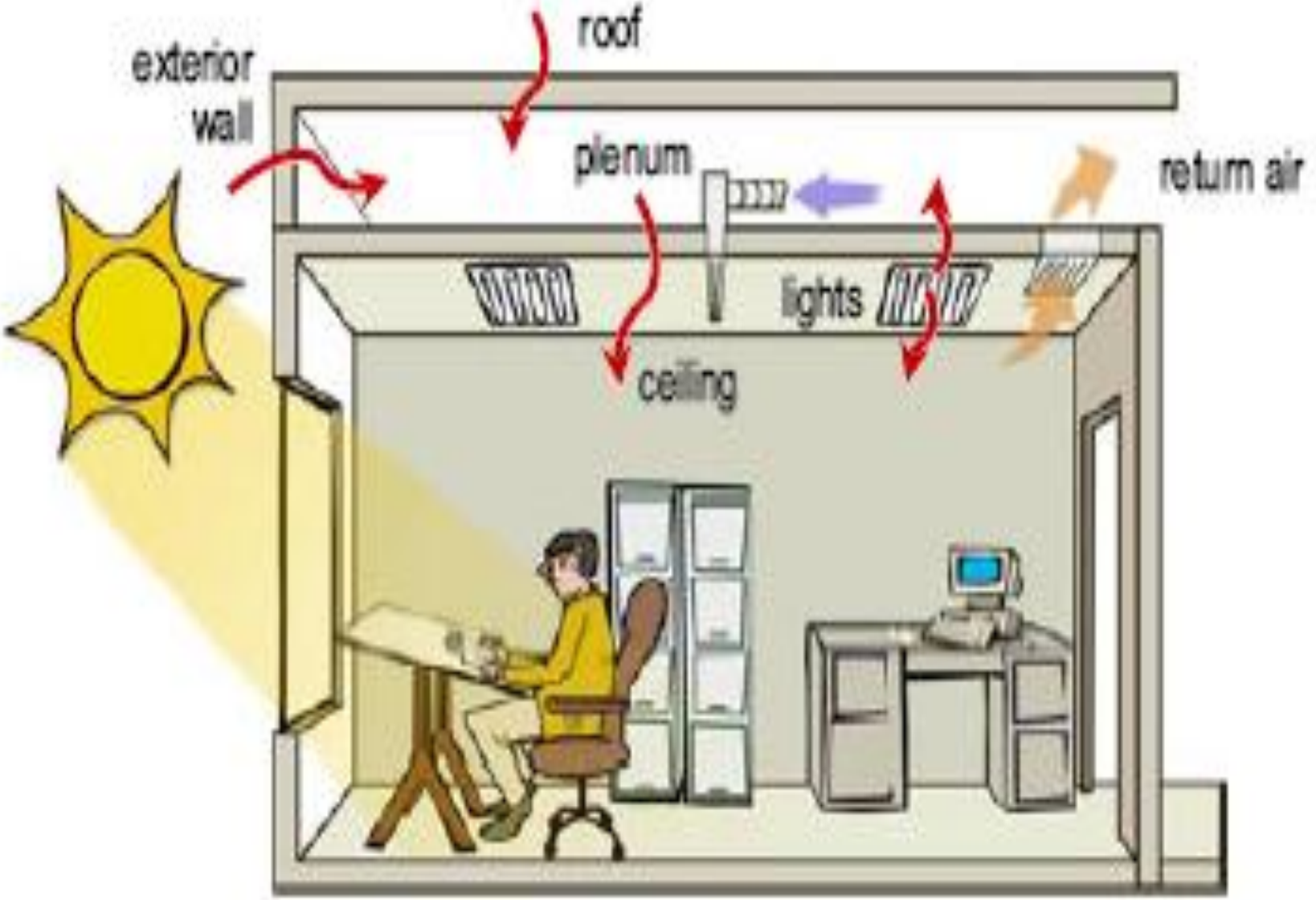


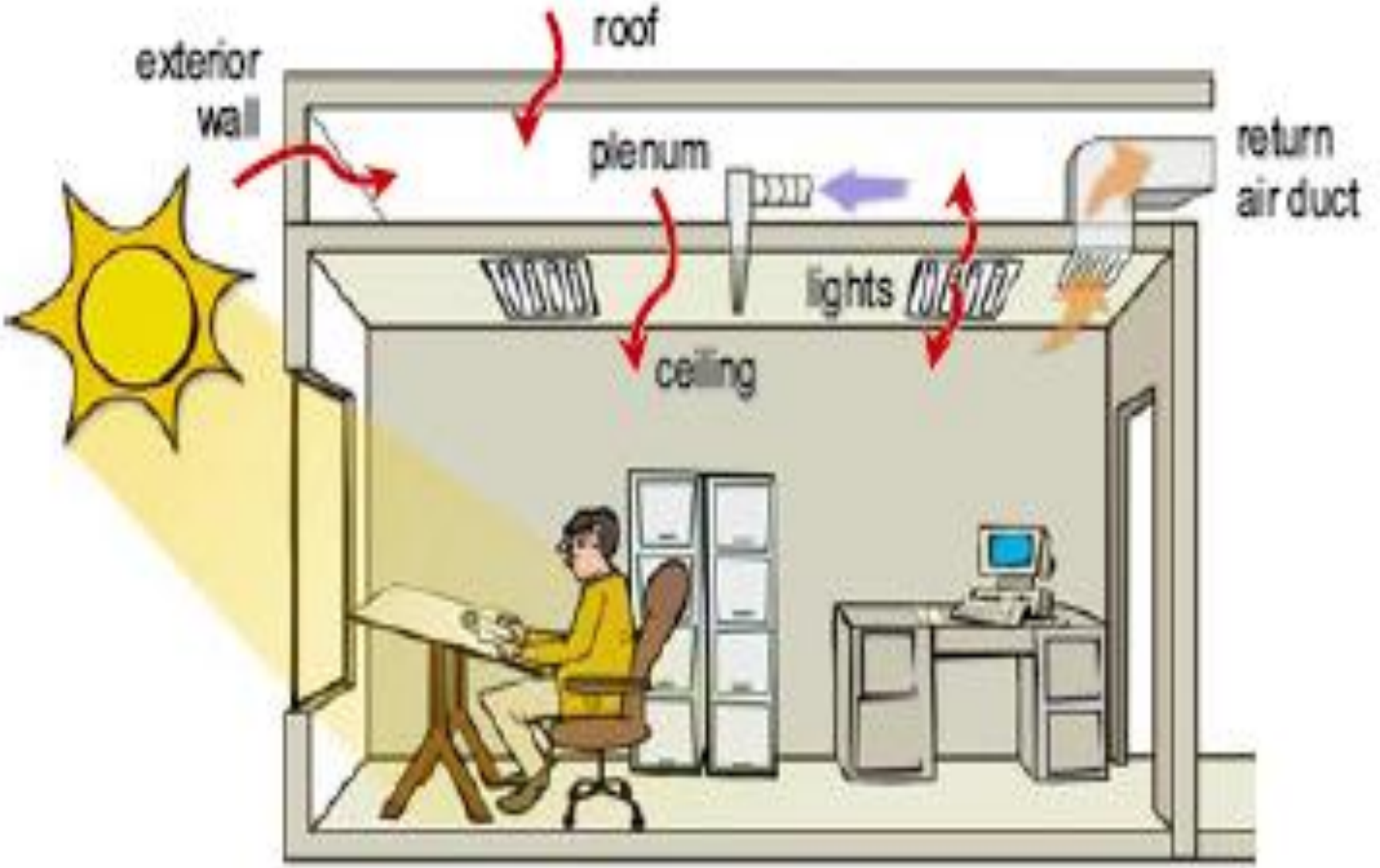
Cooling Load Components



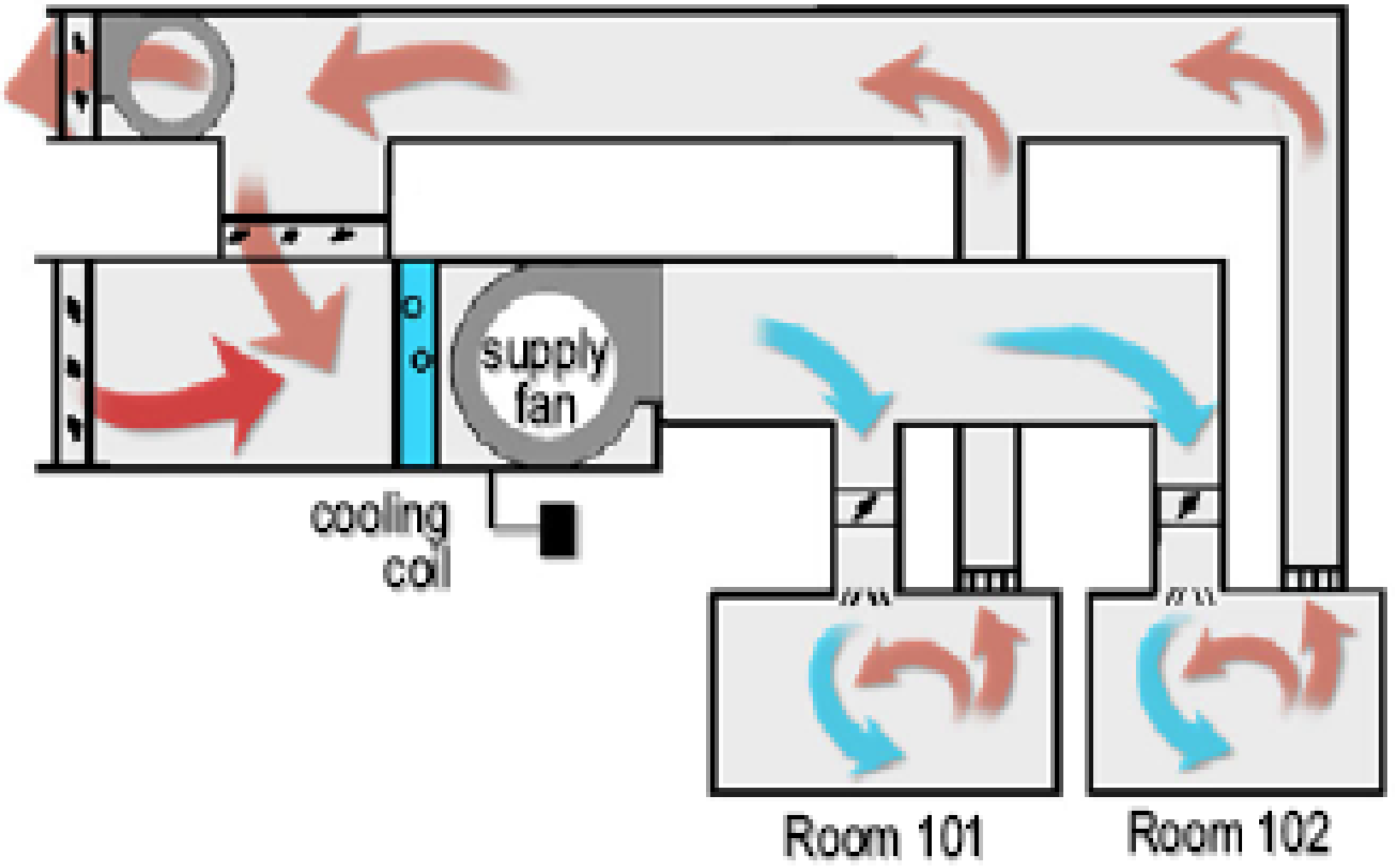
Space versus Plenum Loads

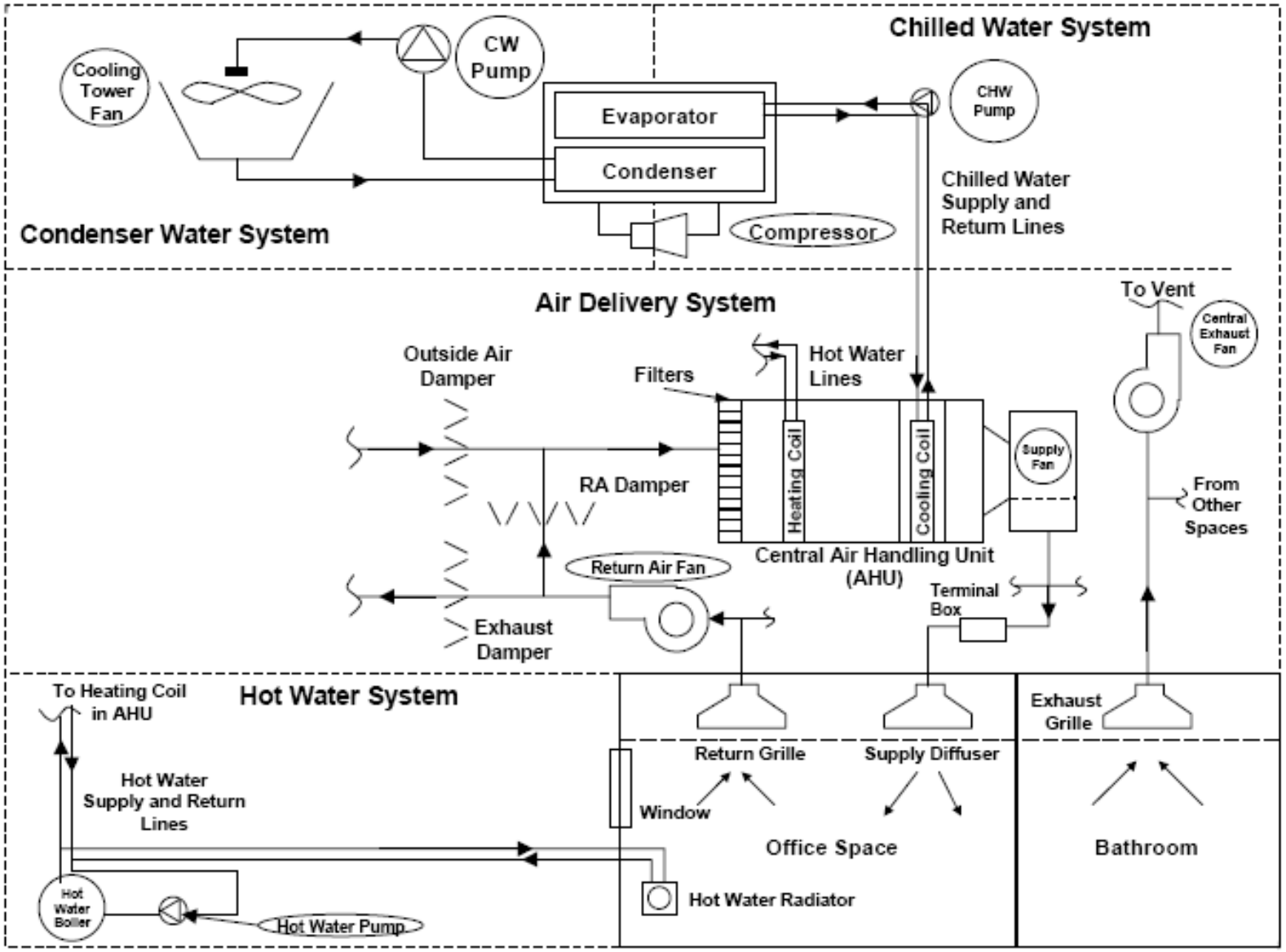


Ducted Return



Multiple-Space Analysis





Central System With a Water-Cooled Chiller

HEATING SYSTEMS

BOILERS

- ***Low Pressure: Steam*** **pressures ↓ 1 bar.**

  Hot water pressures ↓ 10 bar

  T is limited to 120°C.

- ***High Pressure:*** **Steam pressures ↑ 1 bar.**

  Hot water pressures ↑ 10 bar

  T is above 120°C.

HEATING SYSTEMS

SERVICE HOT WATER

Storage type systems:

1- Are used to accommodate varying loads.

2- Suitable for large peak demands.

3- Water in the storage tank is heated by an immersion steam coil, by direct firing, or by an external heat exchanger.

4- The designer must account for standby losses from the tank jacket and connected hot water piping.

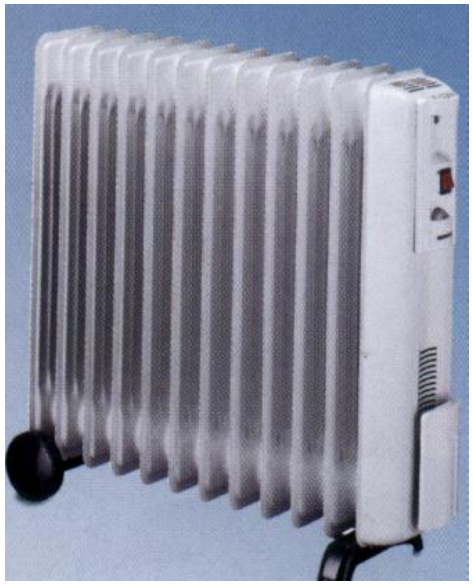
HEATING SYSTEMS

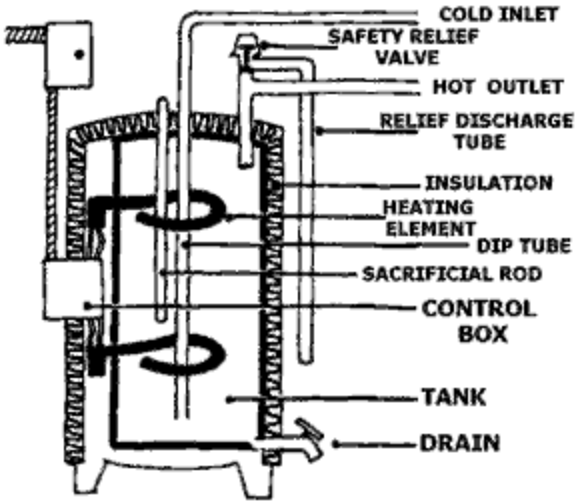
ELECTRIC RESISTANCE HEATING

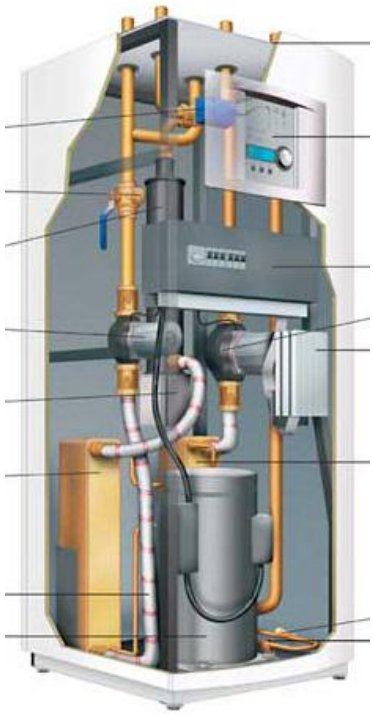
1- Can be used as the heat source in both furnaces and boilers.

2- Are available in the full range of sizes:

- **Residential furnaces (5 to 15 kW)**
- **Large boilers (200 kW to 20 MW).**







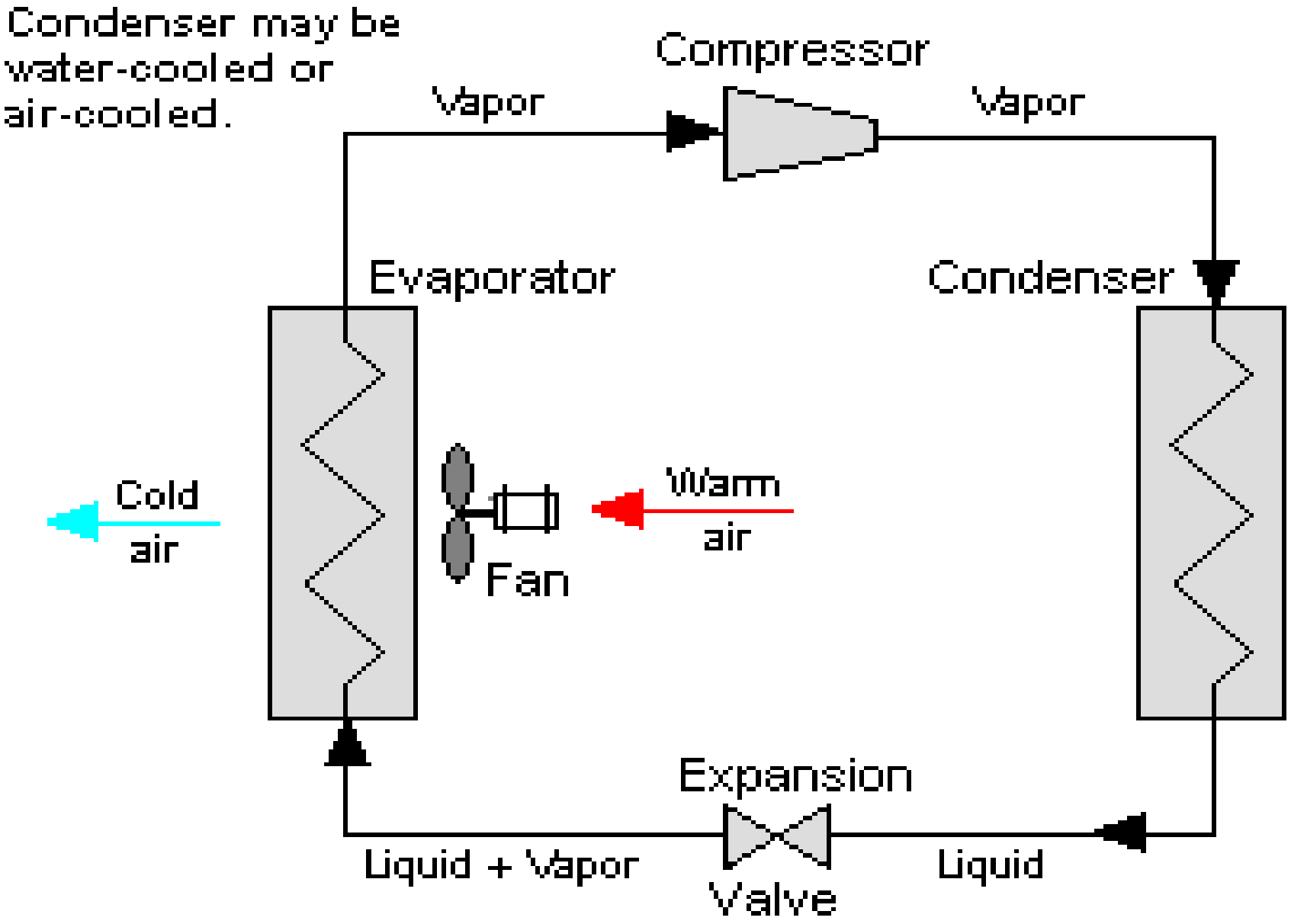
HEATING SYSTEMS

ELECTRIC RESISTANCE HEATING

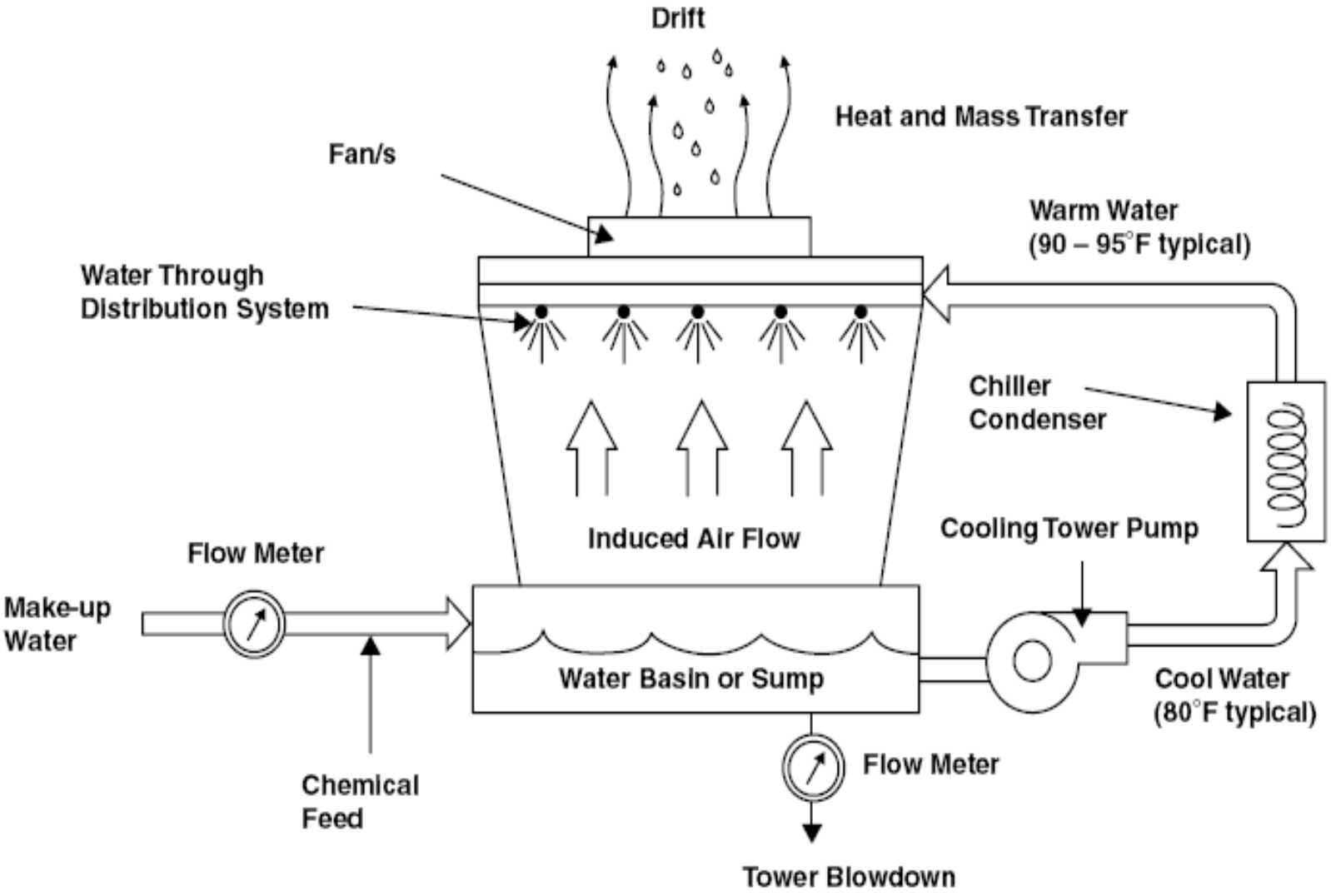
Have attractive features:

- **Relatively lower initial cost**
- **Efficiency near 100%**
- **Near zero part load penalty**
- **Flue gas vents are not needed**

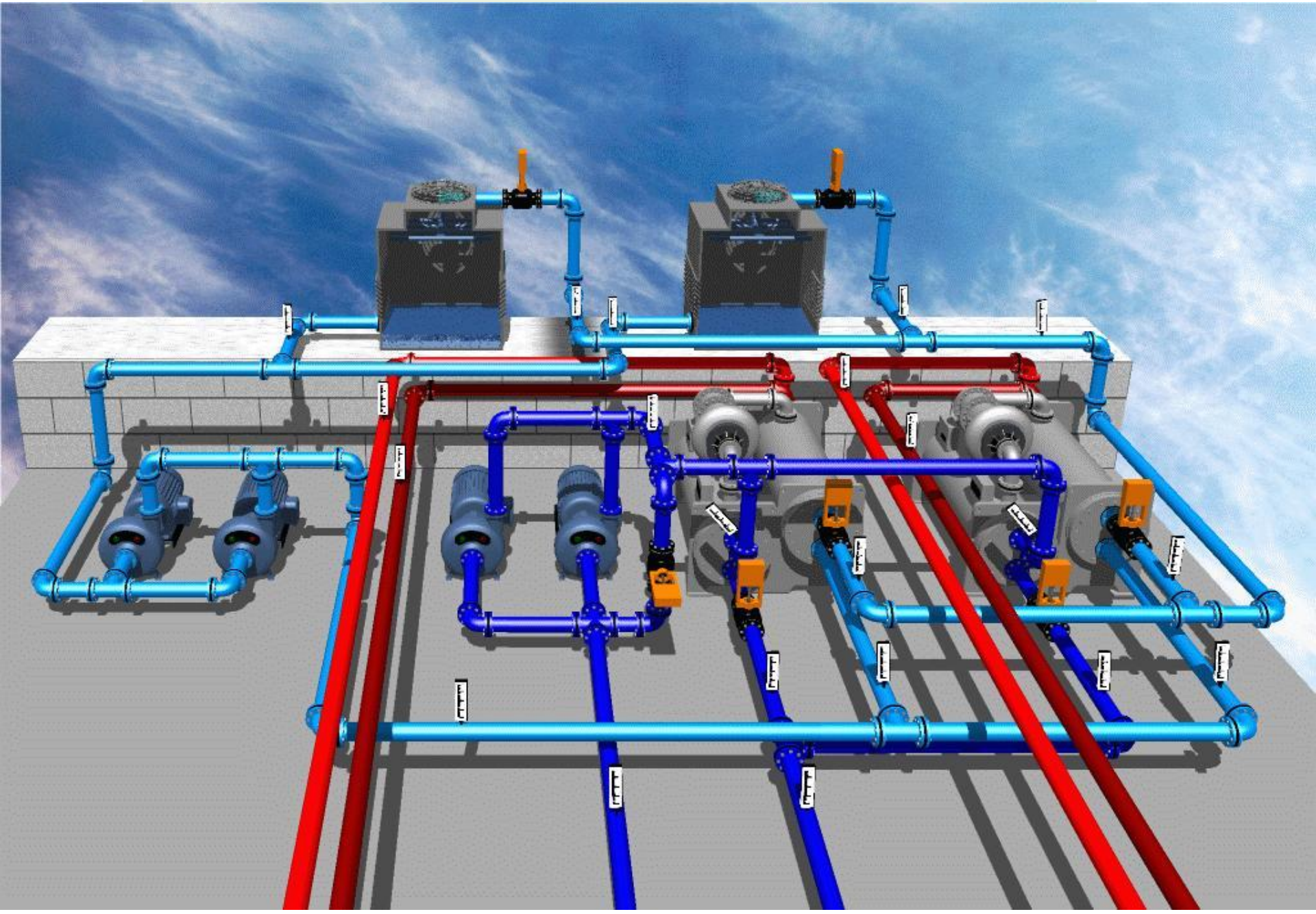
AIR CONDITIONING SYSTEMS



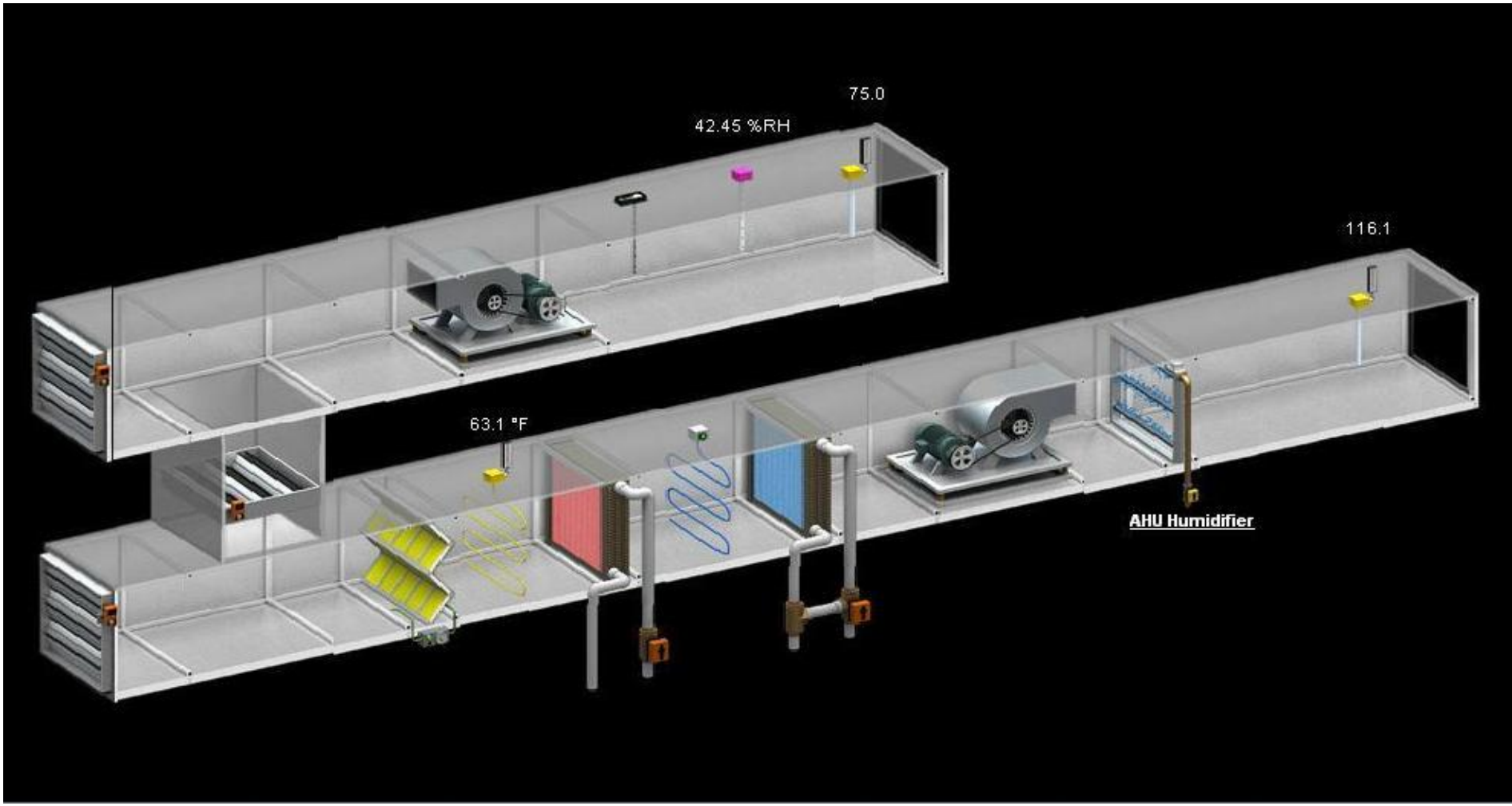
COOLING TOWERS



CHILLED WATER SYSTEMS



AIR HANDLING SYSTEMS



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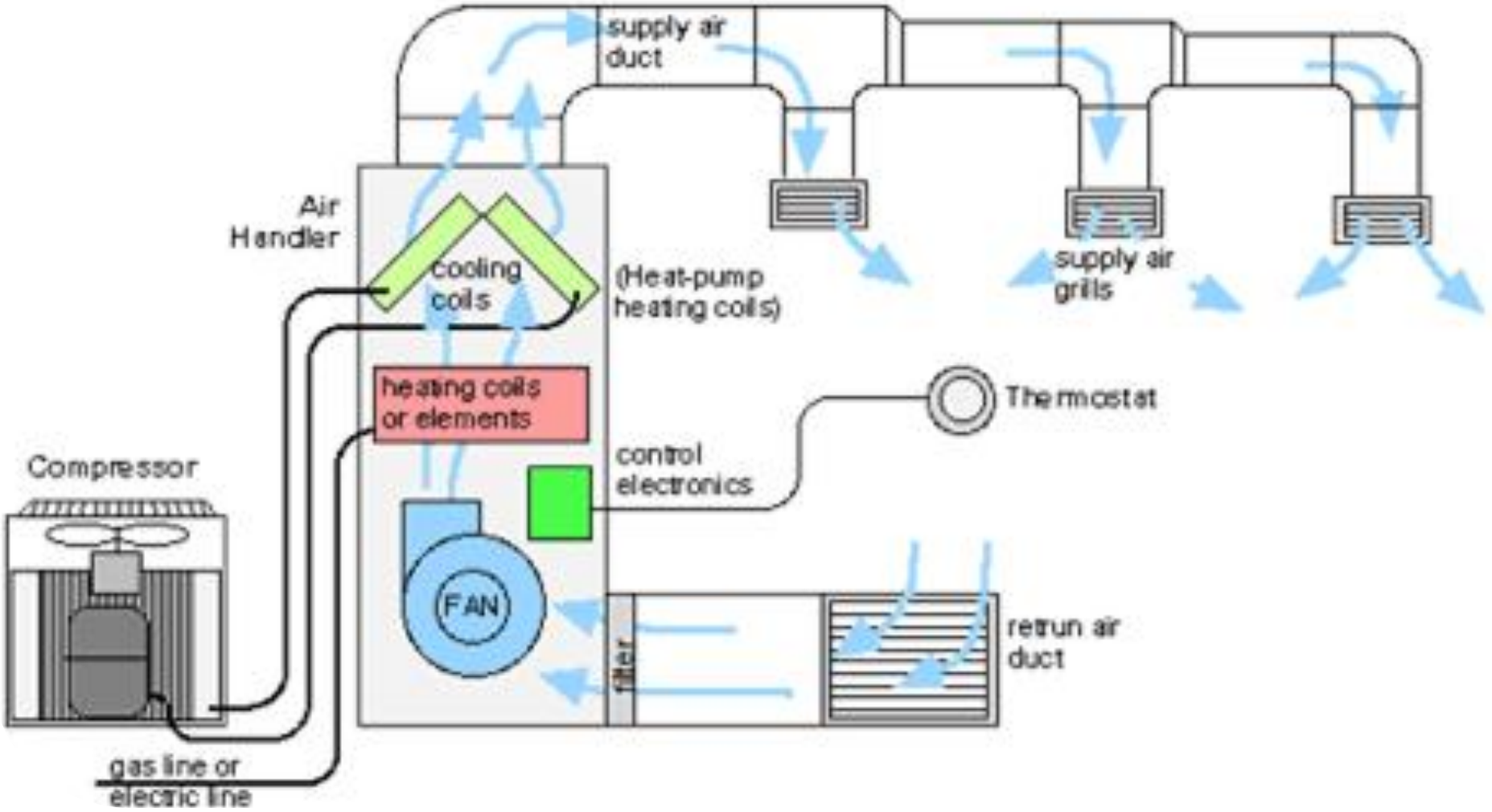
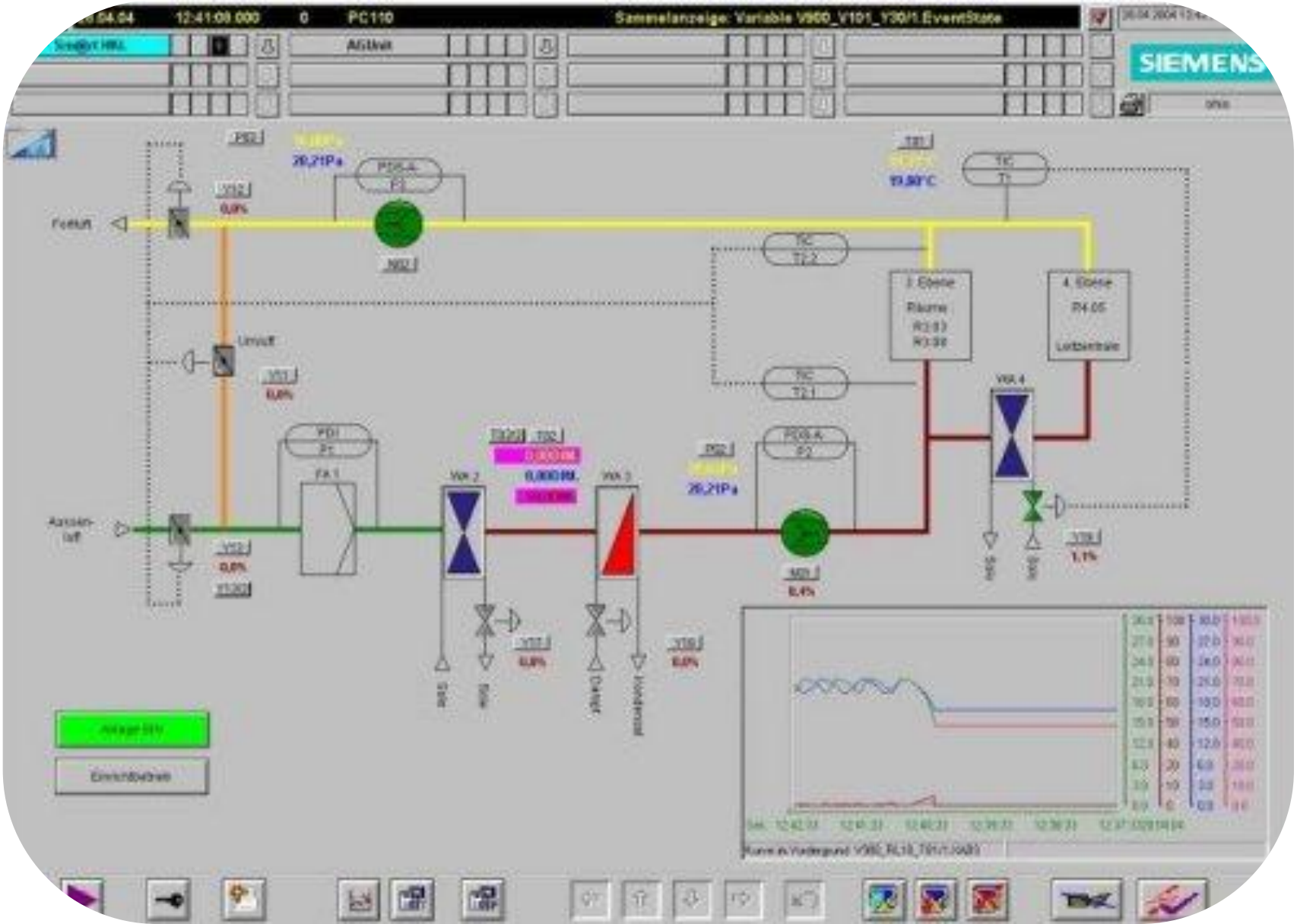


AIR HANDLING SYSTEM CONTROL



CENTRAL SYSTEM ADVANTAGES AND DISADVANTAGES

Some advantages include:

1- Location of equipment is in a centralized, unoccupied location that consolidates and facilitates maintenance.

2- Piping is not within the conditioned space, reducing the possibility of damage in occupied areas.

3- Air systems make it possible to cool the building with outdoor air.

4- Air systems provide flexibility in zoning and comfort control.

CENTRAL SYSTEM ADVANTAGES AND DISADVANTAGES

Some of the disadvantages are:

1- Additional space is required for duct work.

2- The central distribution fan may frequently need to operate during unoccupied hours in cold climates.

3- Proper operation and zone comfort rely on a thorough air-balancing of the system.

4- Extensive cooling and reheating of supply air may be required for systems serving zones with diverse loads.

INCREASING HVAC ENERGY EFFICIENCY

1-Reduce HVAC system operation when building is unoccupied.

2- Reduce HVAC operating hours.

3- Adjust areas that are too hot or too cold.

INCREASING HVAC ENERGY EFFICIENCY

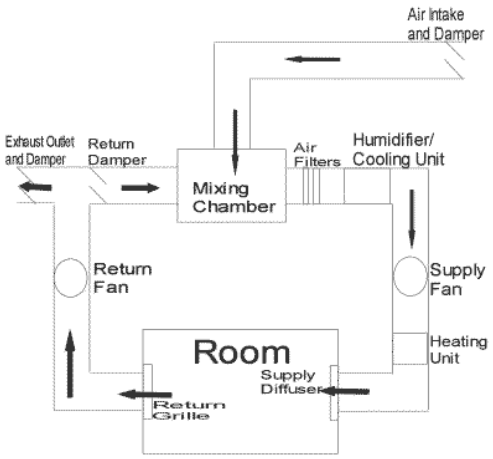
4- Reduce unnecessary heating or cooling.

5- Install an economizer cycle

6- Employ heat recovery

7- Minimize the amount of air delivered to conditioned space.

8- Minimize exhaust and make-up air.



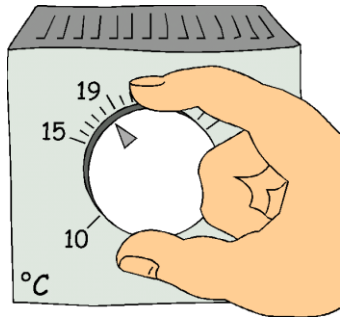
INCREASING HVAC ENERGY EFFICIENCY

9- Implement a regular maintenance plan.

10- Implement an energy management system (EMS)

11- Upgrade fuel-burning equipment.

12- Evaluate thermostat controls and location.



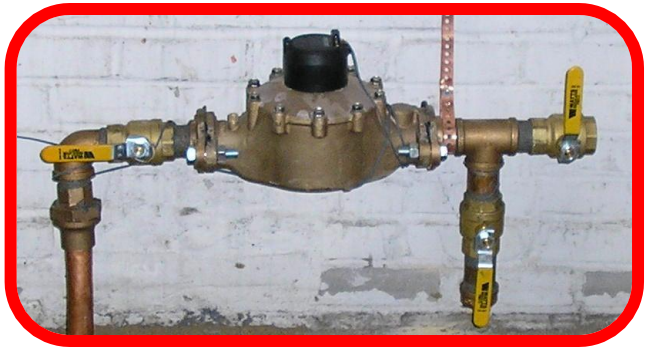
INCREASING HVAC ENERGY EFFICIENCY

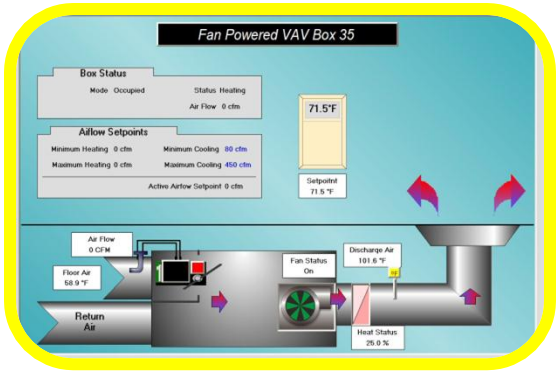
13- Evaluate boiler operations.

14- Use existing cooling towers.

15- Install water meters on cooling towers.

17- Install a variable air volume system (VAV).





http://www.archive.org/download/PICTURES-SOLAR-WIND/SOLAR-WIND-SUMMARY.pdf

Thank you

Any questions